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Diagnostic Utility of Conventional and Advanced MRI in Intra-Articular Synovial Masses

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ABSTRACT

Background: Synovial masses and mass-like lesions encompass a wide spectrum of benign, intermediate, and malignant conditions that affect intra-articular spaces, particularly in large joints such as the knee and shoulder. Accurate characterization and grading of these lesions are essential for clinical management, as many of these entities can mimic each other clinically and radiologically. Magnetic resonance imaging (MRI) has emerged as the modality of choice due to its superior soft tissue contrast and multiplanar capability. This review article provides a comprehensive analysis of the diagnostic utility of conventional and advanced MRI techniques in the evaluation of intra-articular synovial lesions. The review begins with a pathological overview of synovial tumors, emphasizing the World Health Organization (WHO) classification, grading systems such as FNCLCC, and reclassification based on molecular profiling. Following this, technical MRI considerations are discussed, including optimal field strength, coil selection, matrix resolution, and imaging planes for precise anatomical delineation. Key MRI sequences are examined in detail, such as T1-weighted imaging with and without fat suppression, T2-weighted imaging, T2*-GRE for hemosiderin detection, and the value of fluid-sensitive and fat-suppressed sequences. Advanced MRI modalities including dynamic contrast-enhanced MRI (DCE-MRI), diffusion-weighted imaging (DWI), and MR spectroscopy are explored with respect to their role in lesion grading, tissue characterization, and treatment planning. Additionally, specific MRI features of common synovial lesions—including lipoma arborescens, pigmented villonodular synovitis, synovial hemangiomas, and synovial sarcoma—are illustrated. The article concludes by highlighting the role of MRI in evaluating lesion extent, monitoring post-treatment recurrence, and guiding surgical management. Emphasis is placed on a multiparametric imaging approach that combines morphological and functional data for optimal diagnostic yield. Through evidence-based synthesis, this review aims to serve as a practical guide for radiologists and clinicians in accurately diagnosing and managing intra-articular synovial pathologies.

Keywords*:* Conventional, Advanced MRI, Intra-Articular Synovial Masses

INTRODUCTION

Intra-articular synovial masses and mass-like lesions constitute a heterogeneous group of pathological entities originating from or involving the synovial membrane. These lesions include benign proliferative processes, intermediate tumors with local aggressiveness, and malignant neoplasms, each requiring a distinct diagnostic and therapeutic approach. Clinically, they often present with nonspecific symptoms such as joint swelling, persistent pain, mechanical block, or restricted range of motion,

10.48047/jocaaa.2024.33.06.44

which can overlap with inflammatory or degenerative joint disorders.Therefore, imaging plays a pivotal role in their evaluation, facilitating accurate diagnosis and guiding management [1, 2].

Magnetic resonance imaging (MRI) is considered the modality of choice for assessing synovial lesions due to its unparalleled soft tissue contrast, multiplanar imaging capability, and non-invasive nature. It enables precise delineation of lesion morphology, size, anatomical extent, and its relationship with adjacent structures such as cartilage, bone, ligaments, and neurovascular bundles [3]. MRI is particularly useful in differentiating between cystic and solid masses, identifying characteristic signal patterns, and recognizing features suggestive of malignancy, such as inhomogeneity, necrosis, and bone or soft tissue invasion[4].

Conventional MRI protocols—such as T1- and T2-weighted sequences, with and without fat suppression—form the foundation for characterizing intra-articular lesions. These sequences provide essential information on lesion signal characteristics and surrounding joint anatomy. Furthermore, advanced imaging modalities have enhanced diagnostic accuracy. Techniques like dynamic contrast-enhanced MRI (DCE-MRI) offer insight into lesion vascularity and perfusion, diffusion-weighted imaging (DWI) assesses tissue cellularity, and MR spectroscopy evaluates the biochemical composition of lesions, adding value in complex diagnostic scenarios [5].

This review explores the diagnostic utility of both conventional and advanced MRI techniques in characterizing and grading intra-articular synovial masses. Emphasis is placed on understanding the pathological basis of these lesions, optimal imaging strategies, and interpretative criteria that assist in differentiating benign from malignant conditions. Through a comprehensive synthesis of the literature, the article aims to guide radiologists and clinicians in achieving precise diagnoses and informing effective treatment planning.

Pathological Overview

Synovial tissue can give rise to a broad spectrum of neoplastic and non-neoplastic proliferations. The World Health Organization (WHO) classifies synovial tumors into benign, intermediate (locally aggressive or rarely metastasizing), and malignant categories[6]. Benign tumors such as ganglion cysts and lipomas usually remain localized and have excellent prognoses following surgical excision. Intermediate tumors, such as tenosynovial giant cell tumors (localized and diffuse types), may demonstrate aggressive local behavior with a low risk of metastasis [7]. Malignant tumors, including the rare malignant variant of tenosynovial giant cell tumor and synovial sarcoma, pose a greater threat due to their potential for metastasis and recurrence [8].

Grading of soft tissue tumors, especially the malignant forms, is crucial for prognosis and treatment planning. The Federation Nationale des Centres de Lutte Contre le Cancer (FNCLCC) grading system

10.48047/jocaaa.2024.33.06.44

is widely adopted for soft tissue sarcomas and incorporates tumor differentiation, mitotic count, and necrosis[9] . However, the heterogeneity of bone tumors renders uniform grading more complex.

Recent advances in molecular pathology have redefined classifications. For example, synovial sarcoma, historically named for its proximity to joints, is now recognized to arise from primitive mesenchymal cells, characterized by a specific translocation t(X;18) resulting in SYT-SSX fusion genes. This molecular insight has enhanced diagnostic precision and supported reclassification efforts.[10].

Furthermore, conditions such as lipoma arborescens and pigmented villonodular synovitis (PVNS) blur the lines between neoplastic and reactive disorders. PVNS, though classified under fibrohistiocytic tumors, demonstrates neoplastic-like growth patterns, often requiring surgical resection[11]. Similarly, primary synovial chondromatosis, a benign metaplastic disorder, can transform into low-grade chondrosarcoma in rare cases [12].

Comprehensive classification systems now encompass granulomatous diseases (e.g., tuberculosis), deposition disorders (e.g., gout, amyloid arthropathy), vascular lesions (e.g., hemangioma), and miscellaneous pseudotumors (e.g., cyclops lesions), aiding in differential diagnosis [4].

MRI Technique

1. Field Strength, Coils, Matrix, and Imaging Planes: Magnetic Resonance Imaging (MRI) is considered the gold standard for evaluating intra-articular synovial masses due to its high soft tissue contrast and multiplanar capability. A field strength of at least 1.5 Tesla is generally required for adequate resolution, though 3 Tesla systems may offer additional detail without significantly altering diagnostic decision-making. Dedicated joint-specific phased array coils enhance signal-to-noise ratio and spatial resolution. The use of a tailored field of view (FOV) is essential to cover the lesion and adjacent normal tissue. Axial planes are paramount for evaluating lesion extent and compartmental involvement, while sagittal and coronal images provide orthogonal details for surgical planning[13].

2. Basic Sequences:

2.1 T1-Weighted Imaging (T1-WI)

***2.1.1 T1-WI Without Fat Suppression (Non-FS T1-WI*):** Non-fat-suppressed T1-WI is essential for anatomical mapping of lesions relative to intermuscular fat, subcutaneous tissues, and bone marrow. Most synovial masses appear iso- to hypointense relative to muscle, except fat-containing lesions like lipomas, which are hyperintense. These sequences are critical for evaluating anatomical landmarks, guiding biopsy planning, and comparing with post-contrast images[14] .

2.1.2 T1-WI with Fat Suppression (FS T1-WI): Fat suppression techniques aid in differentiating fat from other T1 hyperintense substances such as hemorrhage or proteinaceous fluid. Fat-containing

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lesions lose signal on FS T1-WI, whereas hemorrhagic lesions remain hyperintense, facilitating tissue characterization [13].

2.2 T2-Weighted Imaging (T2-WI): T2-WI provides high contrast for fluid-containing and cystic lesions. High signal intensity suggests a cystic or inflammatory nature, while low signal may indicate hemosiderin, fibrosis, or calcification. Evaluating signal homogeneity and pairing with T1-WI assists in narrowing differential diagnoses[15] .

2.3 T2 Gradient Recalled Echo (T2 GRE): T2* GRE sequences are sensitive to magnetic susceptibility artifacts, aiding in the detection of hemosiderin in conditions like tenosynovial giant cell tumors (TSGCT) and hemophilic arthropathy. Blooming artifacts on GRE help distinguish hemorrhagic and calcified masses, though correlation with radiographs or CT is often necessary[4].

2.4 Value of Fat Suppression Sequences: Fat suppression enhances lesion conspicuity and supports differentiation between fat and other hyperintense structures. STIR sequences offer uniform suppression but are nonspecific, whereas Dixon and spectral fat saturation provide selective and robust fat suppression, especially useful in high-field MRI systems. SPIR and SPAIR techniques are suitable for 3T systems but are prone to inhomogeneities and artifacts [16].

2.5 Fluid-Sensitive Sequences: Fluid-sensitive sequences, including STIR and FS T2-WI, enhance the detection of perilesional edema and cystic structures. These sequences are particularly helpful in distinguishing tumor margins and identifying satellite lesions. FS proton density-weighted images may offer improved signal-to-noise ratios, especially in large joints[17].

2.6 Gadolinium Contrast Enhanced MRI: Gadolinium-enhanced MRI improves synovial lesion evaluation by comparing pre- and post-contrast T1-weighted images (T1-WI), with subtraction imaging recommended for better assessment , provided that scan parameters and patient positioning remain consistent. While contrast may be unnecessary for clearly identifiable lesions (e.g., cysts or lipomas), it is valuable for three key reasons: (1) enhancing synovial membrane visualization for accurate diagnosis and staging, (2) guiding biopsy decisions by targeting highly vascularized areas, and (3) aiding surgical planning, particularly for tumors with muscle-like signal intensity. However, non-fat-saturated precontrast T1-WI is preferred for fatty lesions like lipoma arborescens. Direct MRI arthrography has limited utility, mainly detecting loose bodies or nonspecific synovial thickening [18].

3. Advanced MR Techniques

3.1 Dynamic Contrast-Enhanced MRI (DCE-MRI): DCE-MRI involves the rapid acquisition of sequential images during and immediately after gadolinium contrast administration. It enables evaluation of tissue vascularity, perfusion, and capillary permeability. This technique distinguishes between benign and malignant synovial lesions based on contrast kinetics and enhancement patterns.

10.48047/jocaaa.2024.33.06.44

Synovial sarcomas typically demonstrate early arterial phase enhancement and a steep slope of contrast uptake, whereas benign lesions like synovial chondromatosis show more gradual enhancement . DCE-MRI also aids in identifying optimal biopsy sites by highlighting the most vascularized regions, improving diagnostic yield [19].

3.2 Diffusion MRI: Diffusion-weighted imaging (DWI) evaluates the Brownian motion of water molecules, providing insights into cellular density and tissue integrity[20]. Malignant synovial lesions often show restricted diffusion with high signal intensity on DWI and low apparent diffusion coefficient (ADC) values due to high cellularity. However, overlap exists between benign and malignant lesions, particularly in myxoid-rich tumors. Diffusion MRI is also helpful in distinguishing necrotic tumors from abscesses or hematomas and is increasingly being used in postoperative surveillance for recurrence [4].

3.3 MR Spectroscopy: MR spectroscopy offers metabolic profiling by detecting specific metabolites such as choline, creatine, and lipids within a lesion. Elevated choline levels are typically seen in malignant tumors due to increased cell membrane turnover. Although promising, MR spectroscopy currently lacks specificity and standardization in musculoskeletal imaging and is not routinely used for synovial lesions. It remains an adjunct technique with potential utility in complex cases or research settings[19, 21].

4. MRI Features of Synovial Intra-Articular Masses and Mass-Like Lesions

Role of MRI in Characterization and Grading: MRI plays a pivotal role in characterizing intra-articular synovial masses, allowing differentiation between benign and malignant entities through morphology, signal intensity, and enhancement patterns. Lesions such as lipoma arborescens and synovial lipoma typically exhibit high signal on T1-weighted imaging due to their fat content, with signal suppression on fat-saturated sequences .In contrast, lesions like tenosynovial giant cell tumors (TSGCT) show low signal on both T1- and T2-weighted images due to hemosiderin content, often with blooming artifacts on gradient echo sequences .MRI can also reveal specific morphologic patterns, such as ring-and-arc enhancement in synovial chondromatosis or triple signal intensity in synovial sarcoma, further aiding diagnosis [4].

Similar to other soft tissue tumors, when analyzing signal intensities (SI) on T1-WI and T2-WI, essentially four major groups can be distinguished in synovial tumor and tumorlike conditions [22].Group I: High SI to muscle on T1-WI and intermediate SI on T2-WI are seen in synovial lipoma and lipoma arborescens with suppression of high SI on FS sequences (Fig. 1)[23]. On the contrary, a melanin- containing melanoma shows no signal drop on fat- suppressed imaging [13].

10.48047/jocaaa.2024.33.06.44

Therefore, correct interpretation should rely on the meticulous analysis of all pulse sequences, including FS imaging. Group II: Combination of intermediate SI on T1-WI and high SI on T2-WI is uncommon in synovial tumors, but this may be seen in synovial hemangioma/vascular malformation. Group III: A low SI on T1-WI and high SI on T2-WI are seen in cystic lesions such as synovial and ganglion cyst (Figs. 4 and 5) and in the proliferative initial stage of synovial chondromatosis and synovial chondrosarcoma [24].

Group IV: Low to intermediate SI on T1-WI and low SI on T2-WI may correspond to hemosiderin in old hematomas, localized type and diffuse-type tenosynovial giant cell tumor , amyloid arthropathy, hemophilic arthropathy, and synovial hemangioma complicated by bleeding. Furthermore, when describing signal intensities on T2-WI, it is important to analyze the lesion's homogeneity. In synovial sarcoma, a heterogeneous "triple signal" can be seen on T2-WI consisting of a mixture of cystic, hemorrhagic, and solid components (Fig. 6 and 7) [24, 25].

The presence of signal void can be seen either due to high flow in high- flow vascular malformation or due to the presence of intralesional phleboliths in low-flow vascular malformations/hemangioma, and due to calcifications in the second stage of synovial chondromatosis (Fig. 9) and in the so-called synovial sarcoma . Contrast enhancement is typically absent in ganglion cyst , moderate to marked in tenosynovial giant cell tumors (Fig. 8), and marked and heterogeneous in malignant tumors (Figs. 12) Ring-and-arc enhancement is seen in synovial chondroid lesions (Fig. 9)[25, 26] .

Table 1 Imaging parameters of tumor and tumorlike conditions of the synovium [4]:

Tumor and tumor like	Morphology	T1-WI and T2-WI	Fat sat	T2* GRE	Contrast enhancement pattern
Lipoma arborescens	Soap bubble appearance Cauliflower appearance	Fat signal intensity: high SI on T1- and intermediate SI T2-WI	Suppression of fat signal	No hemosiderin deposition	Absent
Synovial lipoma	Well-defined mass Moniliform appearance	Fat signal intensity: high SI on T1- and intermediate SI on T2-WI	Suppression of fat signal	No hemosiderin deposition	Absent

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Ganglion–synovial cyst	Well-defined mass with homogeneous SI	Low SI on T1-WI, high SI on T2-W	Increased lesion conspicuity	No hemosiderin deposition	Absent or peripheral rim enhancemen
Localized-type and diffuse-type tenosynovial giant cell tumor	Well defined for localized type Ill-defined for diffuse type	Low SI on T1-WI, low SI on T2-W	Increased lesion conspicuity	Low and may demonstrate blooming	Moderate, heterogeneous enhancemen
Synovial chondromatosis	Intra-articular nodules	SI might vary according to Kramer stage	Increased lesion conspicuity	Calcified nodules may cause blooming	Peripheral enhancement Ring-and-arc enhancemen
Synovial hemangioma	Serpiginous morphology Fluid-fluid levels	Low to intermediate SI on T1-WI, high-SI on T2-WI 15–20% show signal void by calcifications on T2-WI	Increased lesion conspicuity	Surrounding synovium may contain hemosiderin	Diffuse enhancement
Amyloid arthropathy	Intra-articular nodule(s	Low SI on T1-WI, low to intermediate on T2-WI	Increased lesion conspicuity	No hemosiderin deposition	Mild, peripheral enhancement
Synovial sarcoma	Well-defined mass with heterogeneous SI	Low SI on T1-WI, heterogeneous intermediate on T2-WI Special scenario: triple signal on T2	Increased lesion conspicuity	Only in hemorrhagic component	Marked and heterogeneous enhancemen

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Synovial chondrosarcoma	Similar to synovial chondromatosi	Similar to synovial chondromatosis	Increased lesion conspicuity	Only in hemorrhagic component	Heterogeneous enhancemen
Tuberculous arthropathy	Destructive, inflammatory arthritis Sinus tract formation	Variable SI on T1-WI, intermediate to low SI on T2-WI Heterogeneous Complications mostly include high SI on T2-WI (periarticular abscess, bursitis, osteomyelitis, sinus tract)	Increased lesion conspicuity	Only in hemorrhagic component	Enhancement of the erosion's rim and the synovium Heterogeneous enhancement

SI signal intensity to muscle

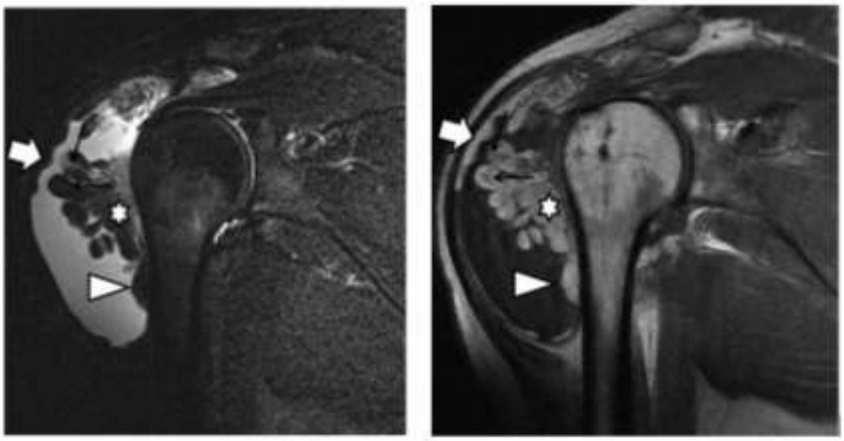

Fig. 1 lipoma arborescens in the subdeltoid bursa. A.Fat-saturated proton density image ; b. Coronal T1-weighted image reveal multi-colliculus like lesions with a wide base (large arrow), frondlike lesions with narrow base (asterisk), a mound-like lesion with a wide base (arrowhead)[27].

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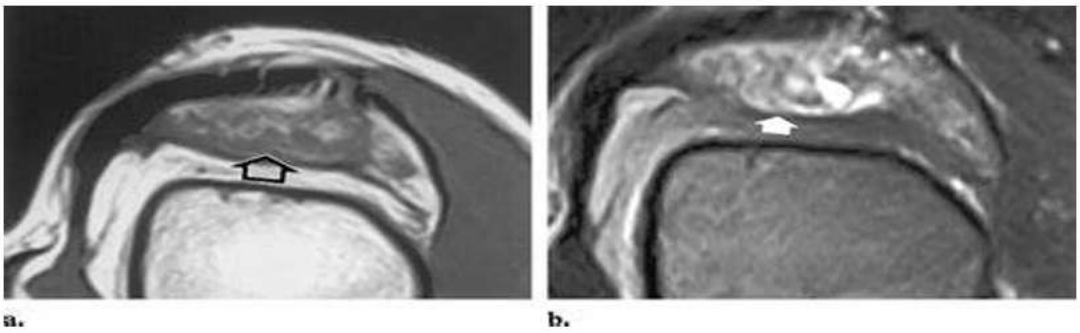

Figure.2 Synovial hemangioma of the knee. (a) Axial T1-weighted MR image shows an intermediate-signal-intensity lesion in the suprapatellar pouch (arrow) containing areas of high signal intensity. (b) On a corresponding axial fat-suppressed T2-weighted MR image, the lesion demonstrates the characteristic circular-linear pattern (arrow)[25].

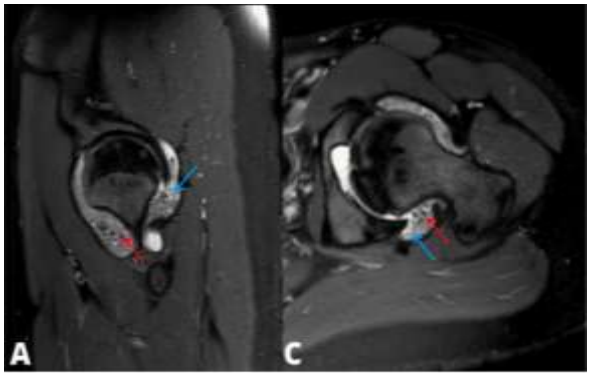

Fig. 3.Synovial chondromatosis. Sagittal(A)and axial (c) T2W fat saturated images showing tiny uniform high and low T2 signal structures within the hip joints indicating non calcified (bluearrow) and calcified (redarrow) synovial chondromatosis[28].

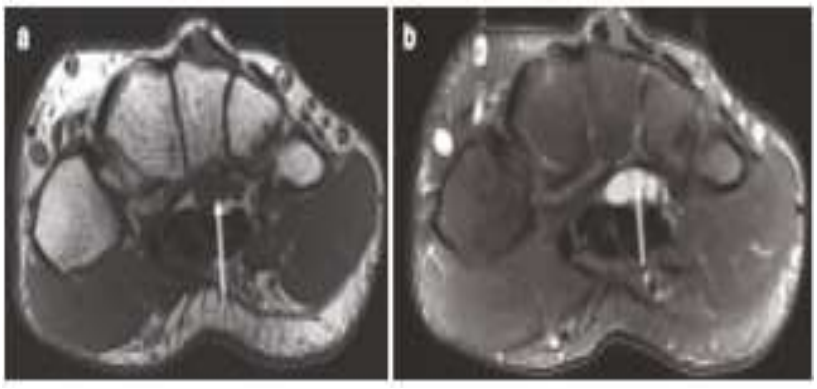

Fig. 4 Multilocular synovial cyst at the carpal tunnel at the level of the distal carpal row deeply located to the flexor tendons. (a) Axial T1-WI; (b) axial FS T2-WI. The lesion is of low SI on T1-WI and high SI on T2-WI, in keeping with fluid content (arrows, a, b)[4].

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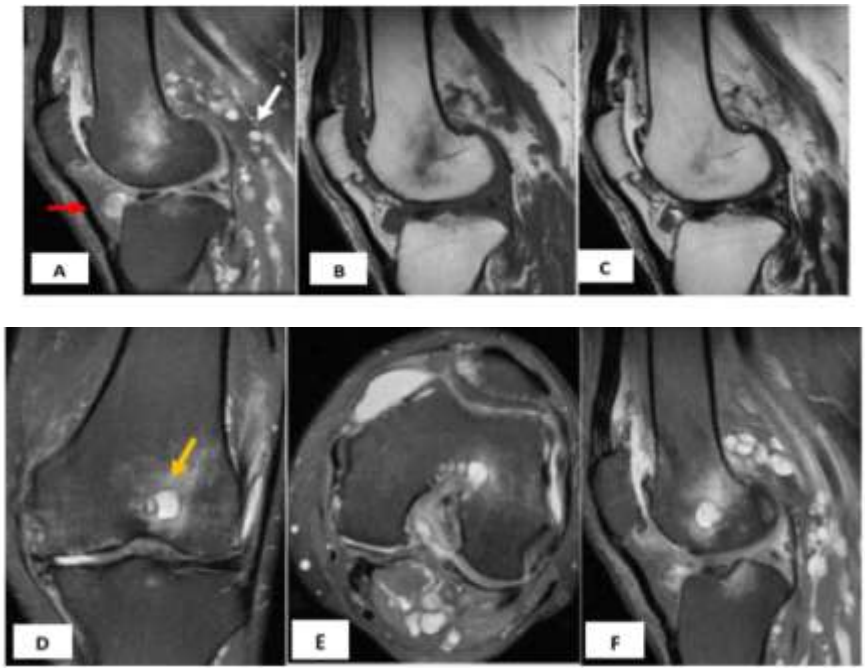

Fig. 5 Right knee synovial ganglion cyst at Hofa's fat . Sagittal STIR (a, f), sagittal T1 (b), sagittal T2 (c), coronal STIR (d), and axial STIR (e) show marked osteoarthritis, lower femur cyst (Geod, yellow arrow), popliteal varicose veins (white arrow), and synovial ganglion cyst (red arrow) displaying low signal at T1 and T2, mixed low and high at STIR[2] .

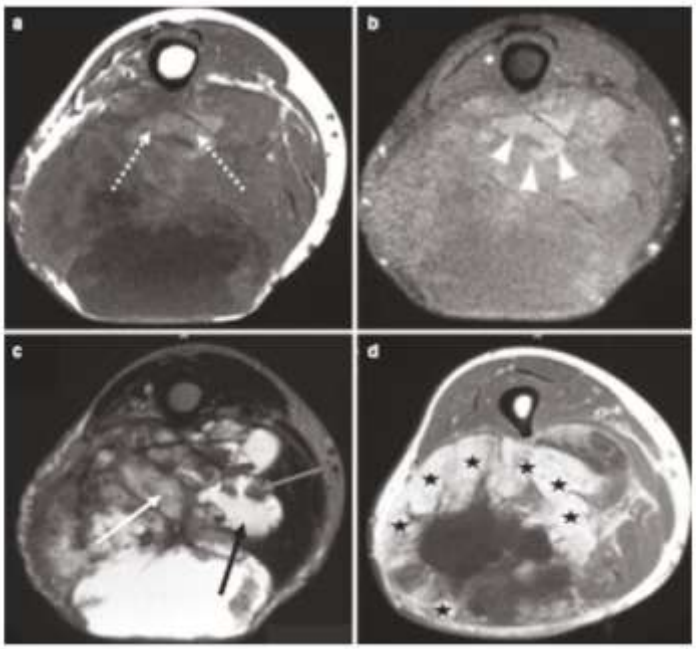

Fig. 6 Synovial sarcoma of the thigh. (a) Axial T1-WI; (b) axial FS T1-WI; (c) axial T2-WI; (d) gadolinium- enhanced axial T1-WI. Axial T1-WI shows a heterogeneous mass at the posterior compartment of the right thigh. Note the presence of intralesional areas of high signal intensity, corresponding to subacute hemorrhage (dotted arrows, a). The persistent high signal intensity foci on FS T1-WI confirm the presence of methemoglobin (arrowheads, b). A triple signal with high (black

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arrow), intermediate (white arrow), and low SI areas (gray arrow) is seen on axial T2-WI (c) with marked, peripheral enhancement of the solid part of the lesion after administration of gadolinium contrast (asterisks)[4].

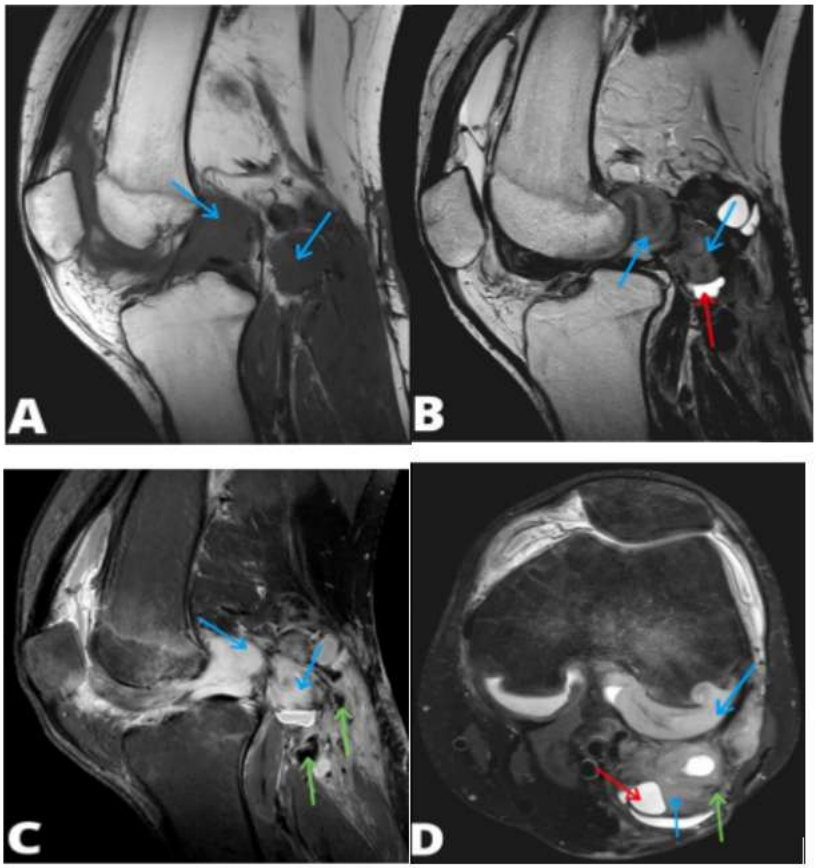

Fig.7. Synovial sarcoma. Sagittal T1W(A), T2W(B), sagittal fat saturated PD (C) ,and axial fat saturated PD (D) images of the knee showing a heterogeneous soft tissue lesion in the postero lateral aspect of the knee with necrosis, cystic degeneration (red arrow in B) ,relatively high signal soft tissue components on T2 W and PD images (blue arrows) and areas of low signal intensity due to dystrophic calcifications and fibrotic bands (green arrows). Thisis consistent with the “triplesign” of synovial sarcoma [28].

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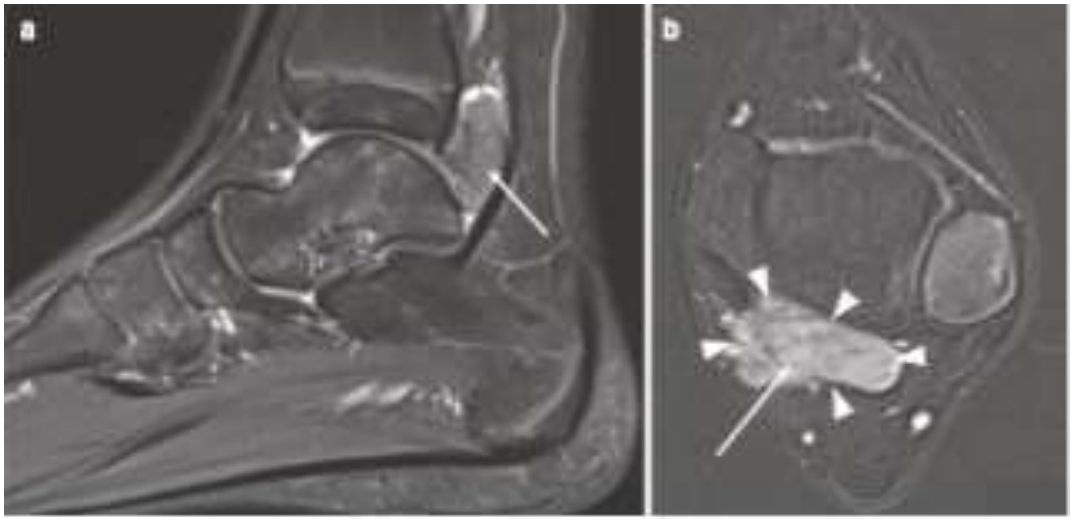

Fig. 8 Diffuse-type tenosynovial giant cell tumor of the left ankle. (a) Sagittal FS proton density-WI; (b) axial subtraction image of FS T1-WI before and after gadolinium contrast. Notice a lesion in the posterior recess of the tibiotalar joint with overall intermediate signal and subtle intralesional foci of low signal (arrow, a). Marked contrast enhancement is seen (arrowheads, b) [4].

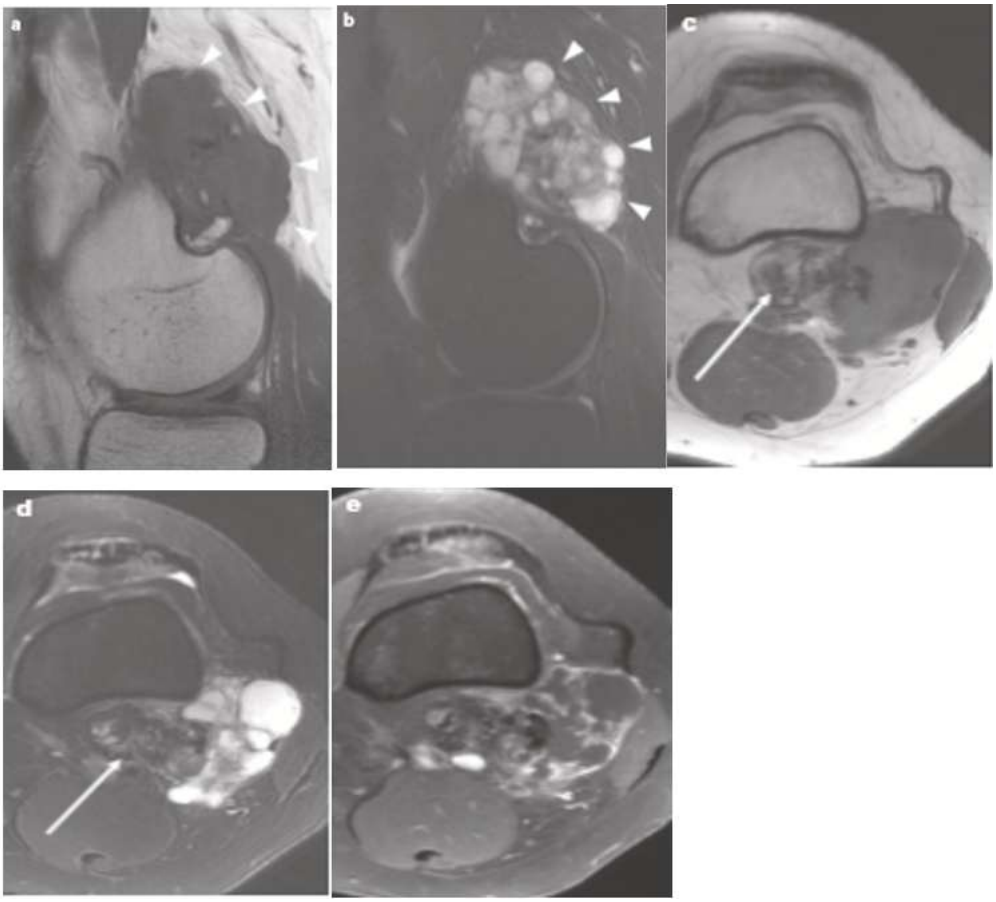

Fig. 9 Immunohistochemically confirmed malignant transformation into a synovial chondrosarcoma. (a) Sagittal T1-WI; (b) sagittal FS T2-WI; (c) axial T1-WI; (d) axial FS T2-WI; (e) axial FS gadolinium-enhanced T1-WI. Multiple intra-articular loose bodies located posterolaterally at the knee

10.48047/jocaaa.2024.33.06.44

joint in a patient with primary synovial chondromatosis (arrowheads, a, b). The axial images show a heterogeneous mass with intermediate to high SI to muscle on T1-WI and mixed SI on T2-WI (arrows, c, d). Tumor size >5 cm and lesion inhomogeneity are suggestive of a malignant chondrosarcoma. No cortical destruction or extra compartmental extension is observed. Gadolinium-enhanced images show ring-and- arc enhancement of the synovial chondromatosis indicating the chondroid nature (e) [4].

Role of MRI in Evaluation of Lesion Extension: Accurate assessment of lesion extension is critical for planning surgical resection and predicting outcomes. MRI allows detailed evaluation of lesion size in all three planes, incorporating peritumoral edema into the measurements. Although a lesion size over 5 cm is associated with worse prognosis, smaller malignant lesions can still be clinically significant [29]. Localization of the lesion within a specific joint compartment and determination of any extracompartmental extension is crucial for staging. For example, intra-articular diffuse-type TSGCT may extend into the infrapatellar fat pad and suprapatellar recess, occasionally mimicking malignant infiltration [25].

MRI is particularly valuable in assessing bone involvement. Cortical destruction and replacement of bone marrow signal on T1-weighted sequences suggest true osseous invasion, a feature more typical of malignancy. Conversely, pressure erosions without marrow signal change, as seen in synovial chondromatosis or amyloid arthropathy, typically represent benign lesions[29]. In addition, synovial sarcomas more frequently demonstrate direct invasion of adjacent compartments and neurovascular encasement, which MRI can delineate with high sensitivity [30].

MRI can also reveal abnormal lymph nodes in malignant cases such as synovial sarcoma, where regional lymphadenopathy is a relatively rare but important prognostic factor. In benign or pseudotumoral conditions like inflammatory arthritis, lymph node enlargement may be present but should not be misinterpreted as malignant spread [31].

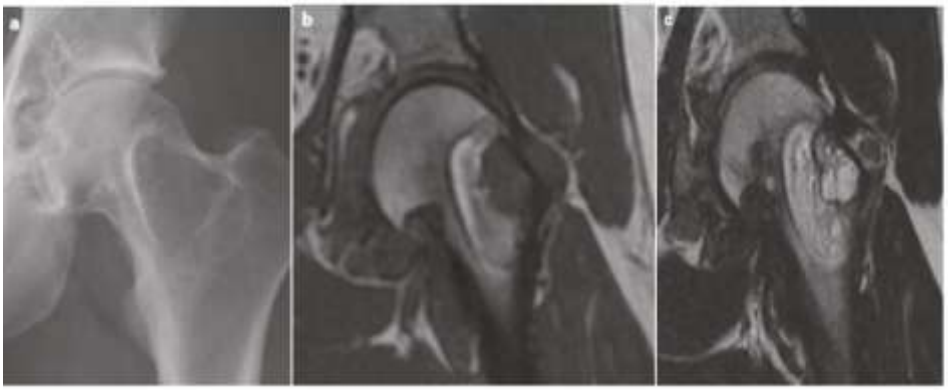

Fig. 10 Intra-articular diffuse-type tenosynovial giant cell tumor of the left hip. (a) Conventional radiograph; (b) coronal T1-WI; (c) coronal T2-WI; a well-circumscribed osteolytic lesion is seen in

10.48047/jocaaa.2024.33.06.44

the proximal femur (a). MR imaging confirms the well-delineated but heterogeneous lesion that is partially located in the joint and causes a huge erosion of the femoral neck (b). There is no surrounding bone marrow edema (c)[4].

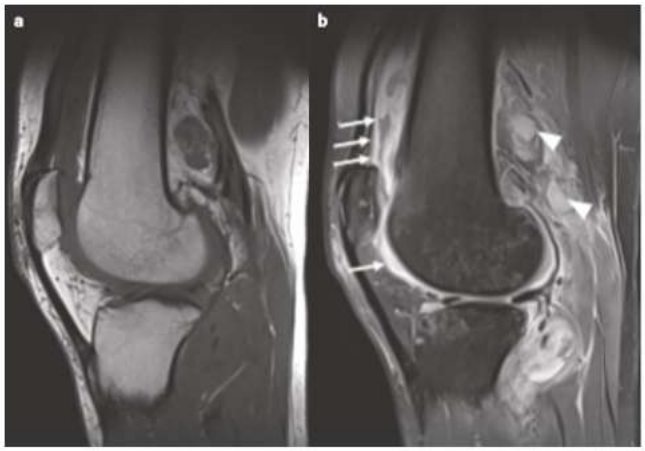

Fig. 11 Rheumatoid arthritis with lymph node involvement in the popliteal fossa. (a) Sagittal T1-WI; (b) sagittal FS T2-WI. Synovial hyperemia including joint effusion and synovial thickening (arrows) and enlarged lymph nodes in the popliteal fossa (arrowheads) are nonspecific findings for inflammatory/infectious diseases [4]

Role of MRI in Follow-Up After Treatment:

MRI serves a central role in post-treatment surveillance of intra-articular synovial lesions, both benign and malignant. For malignant tumors like synovial sarcoma, dynamic contrast-enhanced MRI (DCE-MRI) is particularly valuable in assessing treatment response during and after neoadjuvant chemotherapy. A decrease in lesion size and the presence of macroscopic necrosis exceeding 90% are favorable indicators of therapeutic success. DCE-MRI also helps differentiate viable tumor from post-treatment fibrosis or granulation tissue, which may not be possible with static post-contrast images alone [4].

Diffusion MRI is gaining traction as a valuable adjunct in detecting local recurrences of soft tissue sarcomas, including synovial sarcoma. A combination of absence of high T2 signal, lack of sharp lesion delineation, and preservation of muscle architecture on fat-suppressed T2-weighted imaging is highly sensitive for excluding recurrence. This approach may reduce the need for biopsy or invasive diagnostic steps [32].

Routine follow-up of patients with malignant synovial tumors typically includes clinical assessment, local MRI, and chest CT. Imaging intervals are most frequent in the first three years post-treatment, followed by extended intervals thereafter. Positron emission tomography (PET)/CT may be utilized in select cases to assess metabolic activity, particularly in ambiguous lesions [19, 33].

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In benign synovial conditions with high recurrence risk—such as diffuse-type tenosynovial giant cell tumor (TSGCT), synovial chondromatosis, and diffuse synovial hemangioma, regular MRI follow-up is advised, especially in symptomatic patients. Imaging focuses on identifying new lesions, recurrent masses, or evolving signal characteristics suggestive of malignant transformation, as in rare cases of synovial chondromatosis transitioning to chondrosarcoma [34].

For benign lesions with low recurrence rates like ganglion cysts, imaging follow-up is not routinely required unless clinical symptoms reappear. In such cases, contrast-enhanced MRI is preferred for better delineation of lesion borders and internal architecture [35].

Conclusion:

Magnetic resonance imaging (MRI), through both conventional and advanced sequences, plays an indispensable role in the diagnostic, therapeutic, and follow-up pathways of intra-articular synovial masses and mass-like lesions. Its superior soft tissue resolution, multiplanar capability, and tissue characterization enable early identification, accurate differentiation between benign and malignant lesions, and optimal treatment planning. Advanced techniques such as DCE-MRI and diffusion-weighted imaging further augment diagnostic confidence, especially in complex or recurrent cases. In follow-up settings, MRI remains the gold standard for surveillance and detection of recurrence or transformation. Ultimately, a thorough understanding of MRI protocols and lesion-specific imaging features enhances diagnostic accuracy and guides appropriate clinical decision-making.

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